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(71) Applicant *(for all designated States except US)*: **HORVÁTH, József** [HU/HU]; Hajnalka u. 57, H-2030 Érd (HU).

(71) Applicant and
(72) Inventor: **HORVÁTH, Gábor** [HU/HU]; Hajnalka u. 57, H-2030 Érd (HU).

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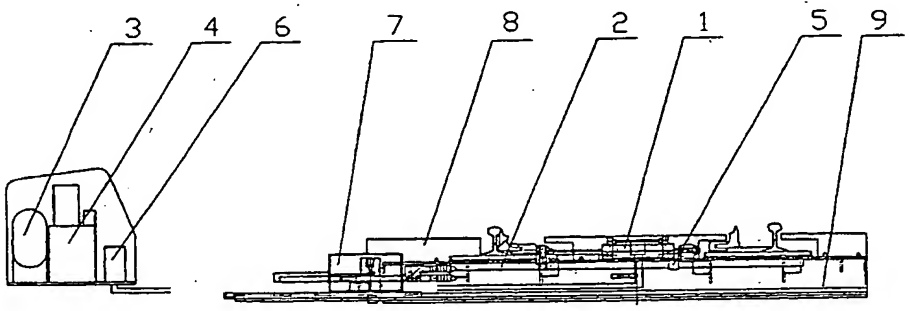
(54) Title: DRIVING GEAR FOR POINTS



(57) Abstract: A points driver primarily for the simultaneous, synchronous setting of the points of large radius switches, their fixing, the checking and signalling of their final position, the working cylinder(s) (1) of which that ensure the joint movement of the point rails of the points and the associated setting, fixing and checking units is (are) connected to the operating unit (3), which preferably has a hydraulic accumulator, connected to the hydraulic power supply (4). The essence of the points driver is that the hydraulic working cylinder(s) (1) is (are) installed in the hollow track sleeper(s) (9). The piston rod connections of the hydraulic working cylinder(s) (1) directly or indirectly move the point rails of the points, or the coupling rod(s) (2) of the point rails.

WO 00/73119 A1

Driving gear for points

The invention relates to a points driver primarily for the simultaneous, synchronous setting of the points of large radius switches. The solution according to the invention relates to the setting of the point rails of points with hydraulic energy, their fixing, the electrical checking and signalling of their final position. The solution does not contain a traditional point rail driver – the usual electric driver – so the title of the invention could also be points setting device.

In practice three phase electric motors are used for the setting of the point rails of switches, which turn, in accordance with the required setting of the points, once in the one direction of rotation and then in the opposite direction of rotation. For this a complex and expensive three-phase uninterruptible power supply is required.

In Hungary the availability of the three-phase electric motors is checked by switching off the three phase power supply from the four leads of the electric motors and checking the leads with a voltage of 48 V. During the operation of the points – so with the three-phase voltage – the checking is interrupted, and without power the points are inoperable.

It is also known, furthermore, that traditional points drivers are positioned next to the tracks, and the points rails are moved by rod linkages that extend past the stock rails. The tracks are subjected to a continually changing load by the vehicles travelling on them, e.g. trains, which load has both static and dynamic constituents. Apart from this the rod linkages attached to the track and the point rails are also subjected to the dilatation loads originating from changes in temperature. All this can lead to significant rail and rod linkage deformation. This effect is especially damaging in the case of the rod linkages that are attached to the point rails and extend past the stock rails, which prevents movement and results in them becoming stuck.

The objective of the invention is primarily the prevention of the characteristics described above, the creation of a solution that solves the problem of points setting more safely and simply than the methods known. A further objective of the invention is for the solution to be developed to be suitable for the simultaneous, synchronous setting of the large radius points of switches, where the mentioned problems appear to a great extent.

We carried out experiments during which we realised that in the interest of progressing further we would have to break away from the use of the traditional three-phase points drivers

and find another solution. Our experiments proved that hydraulic energy is especially suitable in order to attain the set aim, in a device operated with which, in the interest of greater safety, it is preferable to use a hydraulic fluid accumulator. The application of hydraulic fluid accumulators is not unknown, as, for example, American patent description registration number 4 818 136 presents a hydraulic barricade, where as an accessory a so-called secondary energy source is utilised. Also in the international application number PCT/HU 97/00088 in the interest of the increased safety of the control of barriers hydraulic energy and the hydraulic fluid accumulator is used.

The use of hydraulic energy and preferably the hydraulic accumulator, however, is not in itself able to prevent the problems that were described. We realised that working cylinder(s) operated by hydraulic energy need to be placed as close as possible to the point rails in the interest of avoiding their inappropriate operation. We realised that if in the place of the traditional track sleeper(s) we place hollow sleeper(s), then the hydraulic working cylinder(s) may be installed inside this (these). The piston rod connections of the hydraulic working cylinders installed in this way are then able to directly or indirectly move the point rails of the points, or the coupling rod(s) of the point rails.

The invention relates to a points driver primarily for the simultaneous, synchronous setting of the points of large radius switches, their fixing, the checking and signalling of their final position, the working cylinder(s) of which that ensure the joint movement of the point rails of the points and the associated setting, fixing and checking units are connected to the operating unit, which preferably has a hydraulic accumulator, connected to the hydraulic power supply. The essence of the points driver is that the hydraulic working cylinder(s) are installed in the hollow track sleeper(s). The piston rod connections of the hydraulic working cylinder(s) directly or indirectly move the point rails of the points, or the coupling rod(s) of the point rails.

The points driver according to the invention may be used for both for simple switches and for the simultaneous, synchronous setting of the points of large radius switches. With respect to that the functional elements forming the individual structural units of the points driver can be fitted to each other in several versions and multiplied if necessary, the hydraulic working cylinder and its operating unit, the fixing unit and, furthermore, the checking unit are favourably formed as the elements of a modularly constructed system. Not only the hydraulic

working cylinder(s), but the other elements of the modularly constructed system are to be placed in the hollow track sleeper. Primarily in the case of points drivers used for simple switches the hydraulic power supply can also be positioned in the hollow track sleeper.

In the interest of the loading on the points driver mentioned above being reduced as much as possible the hollow sleeper(s) are fixed to the stock rails of the track, and the elements of the modularly constructed system are fixed to the frame structure, allowing the longitudinal dilatation movement, fitted to the hollow sleepers. The frame structure is suitable for correcting the dilatation occurring between the stocks rails and the point rail, and the rail deformation caused by vehicles, for example trains. The points driver according to the solution does not need different settings for winter and summer operation, due to the frame structure the elements of our modularly constructed system "move with" the undesirable rail movements.

The hydraulic power supply may also be placed inside the hollow track sleeper – primarily in the case of simple switches – if necessary, naturally, it may be installed outside of the sleeper, for example, if several working cylinders are used which have a common hydraulic power supply. This latter construction may be necessary for the simultaneous, synchronous setting of the points of large radius switches.

According to our practical experience local maintenance may be made much easier if at least one of the piston rod connections of the hydraulic working cylinder(s) is threaded and is fitted with an adjustable adjusting nut. With this the piston rod connections can be easily connected to the point rail or the coupling rods of the point rails through hinges and coupling lugs.

The essence of the basic operation of the checking unit according to our solution is that we check the position of both point rails. The checking unit is to be fitted to the point rails and has rulers that map the set movement of the point rails and their position as compared to the stock rails, furthermore, its levers operated by the rulers are connected to limit switches.

During the operation of the switch the most important aspect is safety. In the interest of this the fixing unit of our invention has at least two different locking systems, preferably fitted with a hydraulic locking system and a mechanical locking system. The hydraulic locking system contains controlled, continuously adjustable pressure limiting valves on which burst openable and non-burst openable pressure values can be set. So the points driver according to the invention may be used with trailing and non-trailing points.

The other locking system is the mechanically operated safety locking system. This locking system is fitted with disc springs symmetrically positioned perpendicularly to the longitudinal axis of the coupling rod, on both sides of it, tensioned with bolts.

Also in the interest of safety the points driver has a manually operated setting device. As in the case of an emergency the possibility of manual operation has to be ensured. The manually operated setting device is fixed to the hollow sleeper. A screw spindle is connected to the manually operated coupling body of the setting structure. The screw spindle can be connected and disconnected with the nut built into the coupling rod.

The use of the manually operated setting device may be influenced by the hydraulic locking system. In the interest of this not being able to take place the working areas belonging to the piston rod connections are connected through a valve that may also be opened manually.

An example of an advantageous solution of the points driver according to the invention is presented in detail on the basis of the appended drawings, where

- figure 1 depicts a general possible solution of the points driver in diagrammatic side view,
- figure 2 depicts the adjustable version of the hydraulic working cylinder piston rod connection,
- figure 3 depicts the version of the checking unit installed in the hollow track sleeper,
- figure 4 depicts the construction of the mechanically operated safety lock of the fixing units,
- figure 5 depicts the elements of the modular construction system of the points driver and their possible installation in the hollow sleeper,
- figure 6 depicts a practical version of the manually operated setting device,
- figure 7 depicts an electro-hydraulic construction diagram of the hydraulic working cylinder operating unit,
- figure 8 depicts the basic structure of the electric connection unit.

Depicted in figure 1 is a general possible solution of the points driver in diagrammatic side view, the working cylinder 1 of which that ensures the joint movement of the point rails of the points and the associated setting, fixing and checking units is connected to the operating unit

3, which preferably has a hydraulic accumulator, connected to the hydraulic power supply 4. The essence of the points driver is that the hydraulic working cylinder 1 is installed in the hollow track sleeper 9. The piston rod connections of the hydraulic working cylinder 1 directly or indirectly move the point rails of the points, or the coupling rod 2 of the point rails. The hydraulic working cylinder 1 in the depicted case ensures the setting of the points with the help of the coupling rod 2 controlled by the operating unit 3. The fixing unit 5 fixes and locks the given position of the points. In the drawing, diagrammatically, we show the electric connection unit 6 and the checking unit 7, furthermore, we also make reference to the practical application of a protective covering 8. In the case of the use of several working cylinders 1, used preferably for the simultaneous, synchronous setting of the points of large radius switches, the hydraulic working cylinders 1 may have a common hydraulic power supply 4. Figure 1 depicts a possible solution where the hydraulic power supply 4 is installed outside of the hollow sleeper 9.

Figure 2 depicts the adjustable version of the hydraulic working cylinder 1 piston rod connections that allows easier connection. At least one of the piston rod connections of the hydraulic working cylinder 1 is threaded and is fitted with an adjustable adjusting nut 12. The piston rod connections can be connected to the point rails or the coupling rods 2 of the point rails through hinges 11 and coupling lugs 10.

Figure 3 depicts a practical version of the checking unit 7 where the checking unit 7 is installed inside the hollow track sleeper 9. According to the diagram the checking unit 7 is to be fitted to the point rails and has rulers 14 that map the set movement of the point rails and their position as compared to the stock rails, furthermore, its levers 15 operated by the rulers 14 are connected to limit switches 16.

The fixing unit 5 according to our invention has at least two different locking systems, preferably fitted with a hydraulic locking system and a mechanically operated safety locking system 18 according to figure 4. The mechanically operated locking system 18 is fitted with disc springs 21 symmetrically positioned perpendicularly to the longitudinal axis of the coupling rod 2, on both sides of it, tensioned with bolts 22. The safety locking system 18 rolls on rollers 19 along the locking channel on the coupling rod 2, the disc springs lie on fork 20.

A very favourable realisation of the solution according to the invention is when the hydraulic working cylinder 1 and its operating unit 3, the fixing unit 5 and, furthermore, the checking

unit 7 are formed as the elements of a modularly constructed system. Practically all the elements of the modularly constructed system are to be placed in the hollow track sleeper 9. This very advantageous realisation of our solution is illustrated by figure 5. The diagram shows well that the hollow sleeper 9 is fixed to the stock rails of the track, and the elements of the modularly constructed system are fixed to the frame structure 24, allowing the longitudinal dilatation movement, fitted to the hollow sleeper 9. So the hydraulic working cylinder 1, the operating unit 3, the hydraulic power unit 4, the checking unit are attached to the frame structure 24. The hydraulic locking system 23 is also connected here, which is the hydraulic system of the fixing unit 5. The system elements built into the hollow sleeper 9, in order to avoid contamination, are supplied with a supplementary covering 25. The hollow sleeper 9 is positioned according to the diagram, as are the electric connection unit 6 and the manually operated setting device 26.

Figure 6 depicts a practical version of the manually operated setting device 26, which is fixed to the hollow sleeper 9. A screw spindle 30 is connected to the manually operated coupling body 29 of the setting device 26. The screw spindle 30 can be connected and disconnected with the nut built into the coupling rod 2.

Figure 7 depicts the construction diagram of the electro-hydraulic version of the hydraulic working cylinder 3 operating unit. From the operating unit 3 connected to the common hydraulic power unit 4 according to the diagram several hydraulic working cylinders 1 may be operated, primarily for the simultaneous, synchronous setting and fixing of the large radius points of switches, though the safety hydraulic locking system 23.

The hydraulic power supply 4 contains the oil pump 31 and the motor 32 that powers it. Favourably, before the oil pump 31 there is the first filter 33, then after it there is the second filter 34. In the pressure branch of the oil pump 31, following the second filter 34 the oil gets to point P of the route-changing valve 36 through the non-return valve 35 in the operating unit 3 and at the same time into the oil space of the hydro-accumulator 37. In the hydro-accumulator 37 a rubber membrane separates the oil space from the nitrogen propellant gas, which carries out the work.

The over-pressure protection of the hydro-accumulator 37 is carried out by a pressure limiting valve 38 built in according to the prescriptions. The upper and lower values of the operating pressure range of the hydro-accumulator 37 may be set through baroswitches 39 and 40.

Baroswitch 39 on reaching the set upper pressure limit switches the motor 32 off that drives the oil pump 31 of the hydraulic power unit 4, baroswitch 40 on reaching the set lower pressure limit switches on the oil pump 31. The route-changing valve 36 is operated by the left-hand electromagnet 41 and the right-hand electromagnet 42 against springs 43 and 44. Due to the P point seated valve operation of the route-changing valve 36 it is clearance oil-free in the pressure branch, so with the non-return valve 35 it can store in the hydro-accumulator 37, without leakage, the necessary amount of working-oil at the required pressure for the setting of the point rails

On the switching on of the electromagnet 41 of the route-changing valve 36 the oil in the hydro accumulator 37 at a minimum pressure of 40 bar and a maximum pressure of 150 bar is lead from the outlet point of the route-changing valve 36 to the input point of the pressure regulator 45. The pressure regulator is set so that at the outlet point there is the 60 bar oil pressure necessary for setting. This pressure opens the non-return valve of the continually adjustable pressure limiting valve 46 controlled by the hydraulic locking system 23 and the oil flows into the working space A1 belonging to the connection A of the piston rod of the hydraulic working cylinder 1. The piston rod is moved in the direction of connection B, while the coupling rod 2 connected to it sets the point rails.

On feeding the working space A1 the controlled pressure limiting valve 46 at the same time – through the control branch of the valve – opens the non-return valve of the controlled pressure limiting valve 47 and so the displacement volume oil from the working space B1 flows into the oil tank through the non-return valve of the pressure regulator 48 of the operating unit and the controlled open channel of the route-changing valve ending in point T. On setting the point rails in the opposite direction the working space B1 of the hydraulic working cylinder is filled. The opening and closing of the valves is analogous with that presented above.

The opening pressure from the hydraulic working cylinder of the controlled pressure limiting valves 46 and 47 is set to a pressure value equivalent to the burst open force. Naturally as the pressure limit can be continuously adjusted, the opening pressure, if the usage so requires, may also be set to a non-burst-openable value.

In figure 7 we present a very advantageous construction of our solution, primarily for the simultaneous, synchronous setting of the points of large radius switches, their fixing, the checking and signalling of their final position, with which several working cylinders 1 are

used, jointly with several hydraulic locking systems 23. The synchronous setting of the points takes place according to that written down previously. On the diagram there are connection points 49-53, through which if necessary measurements may be carried out.

Figure 8 depicts the basic construction of the electric connection unit 6. The electric system is split up into two main parts: the first part is the operating and control circuit of the motor 32 that drives the oil pump 31, the second part is the hydraulic valve controlling circuit and the circuit of the contacts that check the final position of the setting unit.

The motor 32 circuit receives continuous power, so that any pressure drops that occur during the operation of the unit may always be made up independently of whether the setting unit is at that moment being controlled or not. The pressure limiting valve 38 is in the electric circuit, which controls the oil pump 31, depending on the pressure, through the baroswitch 39. The baroswitch carries out the switching on of the motor 32 when the pressure goes under 100 bar and switches the operation of the oil pump 31 on reaching 150 bar. The circuit contains an auxiliary magnet switch 54, which is necessary because of the motor-current switching. On the effect of the closing of the baroswitch 39 the auxiliary magnet switch 54 switches on and so the motor 32 is switched on. With the increase in the pressure the baroswitch 39 switches off and breaks the auxiliary magnet switch 54, and that in turn breaks the electric circuit of the motor 32. The motor protecting switch in the circuit, which is positioned built into the motor 32 and come into operation in the case that the motor 32 is overloaded. In the case of a possible separate power unit in the case that the cover is opened or removed the contact of the switch 56 breaks the electric circuit of the motor 32, so preventing accidental harm to a person dealing with the points driver.

The circuit of the hydraulic valve control magnets depending on the position of the setting unit prepares the controlling of the one or the other control valves, and, at its final position, the setting unit forms current paths suiting this position for the checking unit 7. The control of the points driver is operated through the three position – a, 0, b – electromagnets 41, 42 by the route-changing valve 36. The setting of the points takes place with the route-changing valve 36 controlled by the coil 410 of the electromagnet 41 in the one direction and by the coil 420 of the electromagnet 42 in the other direction.

The final position switches 57,58 participate in the valve control and the final position checking process. This means that on setting the magnet of the valve controlling the setting

receives excitation until the setting unit gets to its final position. And at the end of the setting the operation of the relay that means the stopping of the process and the response of the checking unit 7 is only resulted by the joint correct operation of the final position switches 57, 58. On the burst opening of the points the final position switch 57 or 58 of the given side breaks the circuit of the relay of the checking unit 7, by the time this drops and at the same time shunts the coil of the final position checking relay from the checking circuit, so the current strength increase taking place in the circuit releases the small breaker positioned in the circuit signalling the fact of the points being burst open. In the circuit the task of the contact of the baroswitch 40 is in the interest of avoiding unsatisfactory setting due to a reduction in pressure to signal it with the loss of the checking of the points. Switch 59 signals the fact of the protective cover 8 being opened or removed, and switch 60 signals the deviation of valve 49 from its closed position that is to be operated during manual setting.

The setting of the points driver in connection with figure 7 is presented in detail.

The basic state before setting is when the connection side point rail is normally flush up against the stock rail (the point turns to the right). In this situation:

- The connection side fixing is live;
- the route-changing valve 36 is in closed position – position 0 -;
- the hydro-accumulator 37 is in a charged condition;
- the pressure limiting valves are in a closed state towards the hydraulic working cylinder 1 and so locks this hydraulically;
- valve 49 connecting the A1 and B1 working spaces is closed.

Now we shall examine the setting process when the points are changed to a left turning position. At this time electromagnet 41 of the route-changing valve 36 receives control current – position a -. The oil flows into the working space A1 of the hydraulic working cylinder through the pressure regulator 45 at a regulated, continuous pressure on the opening of the non-return valve of the controlled pressure limiting valve. The oil returns to the oil tank from working space B1 according to that written down earlier.

The connections A, B of the piston rod of the hydraulic working cylinder – on both sides – are hinge connected to the coupling rod 2. On the movement of the coupling rod 2 the "unlocking" takes place through the mechanical connection of the bolt of the bolted lock

device known independently, preferably prescribed in Hungary, and the point rail. After unlocking the resetting is realised, the flush fitting of connection side B point rail to the stock rail, the independently known bolted fixing and locking. At the same time as the known bolted fixing the hydraulic locking is also realised – as a result of the close state of the pressure limiting valve 46.

The rulers 14 of the checking unit 7 are connected to the point rails independently of the coupling rod 2, which moving together with both point rails operate the electric limit switches 16 in accordance with the position (final position) of the point rails.

The B connection "side" limit switch 16 at the time of the flush fitting to the appropriate point rail and the independently known bolted fixing:

- switches of the electromagnet 42 of the route-changing valve 36, the spring 44 of the route-changing valve puts the valve into the zero position – 0 position - , and so the setting oil flow is terminated;
- signals back the establishment of a normal setting.

With the termination of the oil flow the controlled pressure limiting valves 46 and 47 close in the direction of the hydraulic working cylinder and hydraulically lock the position.

In accordance with the movement of the rulers 14 the limit switches 16 provide information if normal setting has not taken place for some reason (e.g.: obstruction, fault).

The hydraulically fixed and locked position of the coupling rod 2 is guaranteed by a mechanically operated safety locking system 18, with the help of the disc springs 21. This automatically operating structure which has its effect on the locking channel built into the coupling rod 2 favourably with a force adjustable between 1.5-2 KN. The joint hydraulic and mechanical locking force is favourably 7-12 KN.

On bursting open the bursting open force appearing on the coupling rod 2 is transmitted to the piston of the hydraulic working cylinder and so overpressure is created in the working cylinder on the side opposite to the bursting open direction. This overpressure opens – depending on the direction of the bursting open – the controlled pressure limiting valve 46 or 47, and the oil flows through the pressure regulator 45 or 48 and the route-changing valve 36 into the opposite working space A1 or B1. So a vacuum can not be created in the bursting open side cylinder space – working space A1 or B1.

We may carry out the setting with spare energy if the lever on the route-changing valve is moved in the desired direction and held there. If there is enough spare energy in the hydro-accumulator – and in general it is enough for two settings – then the setting takes place.

If there is not enough spare energy then the setting may be carried out with the manual setting device 26.

The points driver according to the invention proved to be excellent in practical trials also, with its help the setting of simple points or even the simultaneous, synchronous setting of the large radius points of switches may be realised simply, safely with a low maintenance demand.

Claims

1. A points driver primarily for the simultaneous, synchronous setting of the points of large radius switches, their fixing, the checking and signalling of their final position, the working cylinder(s) of which that ensure the joint movement of the point rails of the points and the associated setting, fixing and checking units is (are) connected to the operating unit, which preferably has a hydraulic accumulator, connected to the hydraulic power supply, **characterised by** that the hydraulic working cylinder(s) (1) are installed in the hollow track sleeper(s) (9), the piston rod connections (A, B) of the hydraulic working cylinder(s) (1) directly or indirectly move the point rails of the points, or the coupling rod(s) (2) of the point rails.

2. The points driver according to claim 1, **characterised by** that the hydraulic working cylinder (1) and its operating unit (3), the fixing unit (5) and, furthermore, the checking unit (7) are formed as the elements of a modularly constructed system.

3. The points driver according to claim 2, **characterised by** that the elements of the modularly constructed system are placed in the hollow track sleeper (9).

4. The points driver according to claim 3, **characterised by** that the hollow sleeper(s) (9) is (are) fixed to the stock rails of the track, and the elements of the modularly constructed system are fixed to the frame structure (24), allowing longitudinal dilatation movement, fitted to the hollow sleeper(s) (9).

5. The points driver according to any of the claims 2-4, **characterised by** that the hydraulic power supply (4) is also positioned in the hollow track sleeper (9).

6. The points driver according to any of the claims 1-5, **characterised by** that in the case that several working cylinders (1) are used, favourably in the case of the simultaneous, synchronous setting of the points of large radius switches, the working cylinders (1) have a common hydraulic power supply (4).

7. The points driver according to any of the claims 1-6, **characterised by** that at least one of the piston rod connections (A, B) of the hydraulic working cylinder(s) (1) is threaded and is fitted with an adjustable adjusting nut (12) and the piston rod connections (A, B) are connected to the point rails or the coupling rod(s) (2) of the point rails through hinges (11) and coupling lugs (10).

8. The points driver according to any of the claims 1-7, **characterised by** that the checking unit (7) is to be fitted to the point rails and has rulers (14) that map the set movement of the point rails and their position as compared to the stock rails, furthermore, its levers (15) operated by the rulers (14) are connected to limit switches (16).

9. The points driver according to any of the claims 1-8, **characterised by** that the fixing unit (5) has at least two different locking systems, preferably fitted with a hydraulic locking system (23) and a mechanically operated safety locking system (18).

10. The points driver according to claim 9, **characterised by** that the hydraulic locking system (23) contains controlled, continuously adjustable pressure limiting valves (46, 47).

11. The points driver according to claim 10, **characterised by** that burst openable and non-burst openable pressure values are set on the pressure limiting valves (46, 47).

12. The points driver according to any of the claims 9-11, **characterised by** that the mechanically operated safety locking system (18) is fitted with disc springs (21) symmetrically positioned perpendicularly to the longitudinal axis of the coupling rod (2), on both sides of it, tensioned with bolts (22).

13. The points driver according to any of the claims 1-12, **characterised by** that it has a manually operated setting device (26), which is fixed to the hollow sleeper (9), and a

screw spindle (30) is connected to the manually operated coupling body (29) of the setting device (26), the screw spindle (30) can be connected and disconnected with the nut built into the coupling rod (2).

14. The points driver according to any of the claims 10-13, **characterised by** that the operating unit (3), connected to the hydraulic power supply (4), which favourably has a hydraulic accumulator (304), is connected to the working space (A1, B1) belonging to the piston rod connections (A, B) of the hydraulic working cylinder (1) through the hydraulic locking system (23).

15. The points driver according to any of the claims 10-14, **characterised by** that the control of the individual continuously adjustable pressure limiting valves (46, 47) is realised by the other pressure limiting valves (47, 46).

16. The points driver according to claim 14, **characterised by** that the working spaces (A1, B1) belonging to the piston rod connections (A, B) are connected to each other through the openable valve (49).

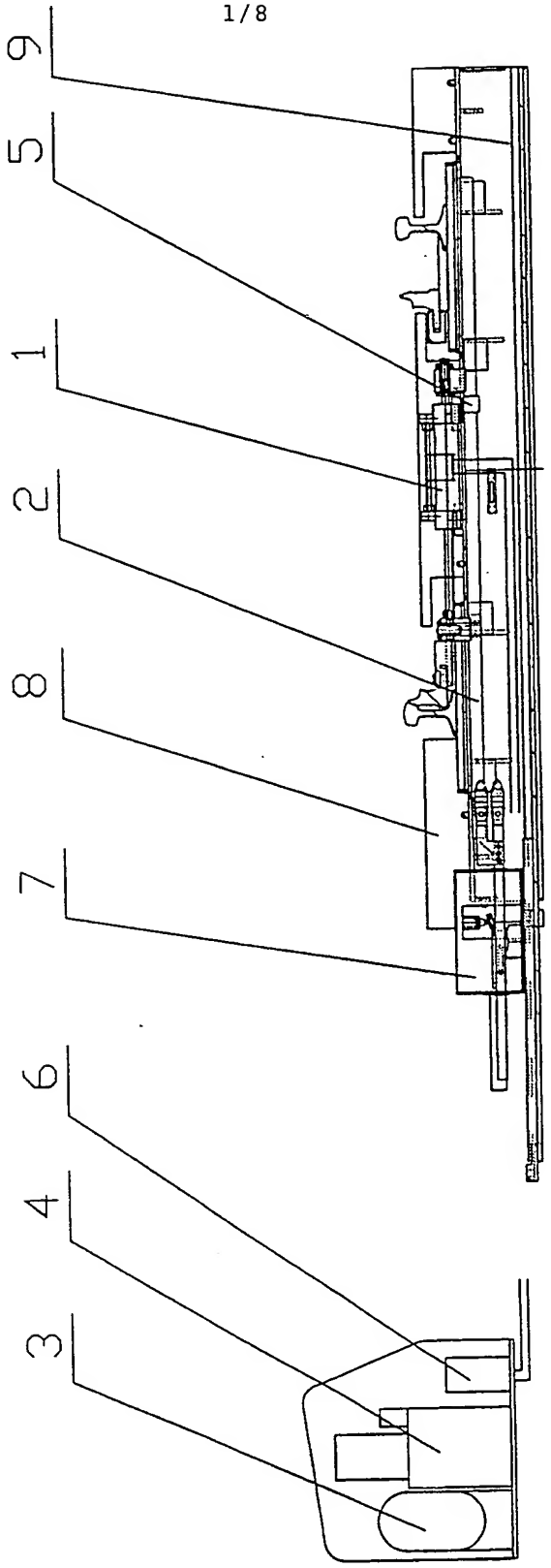


Fig. 1.

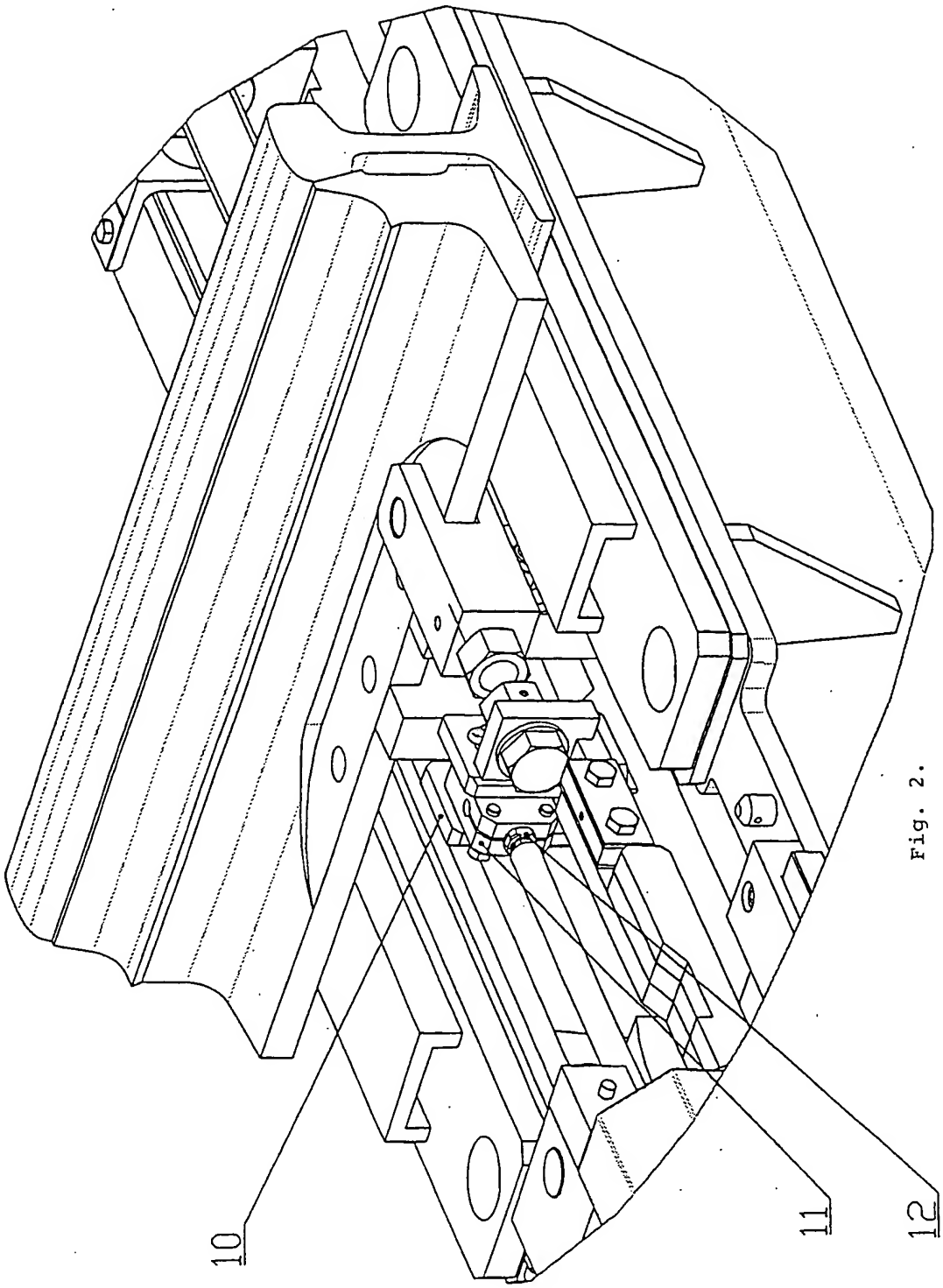


Fig. 2.

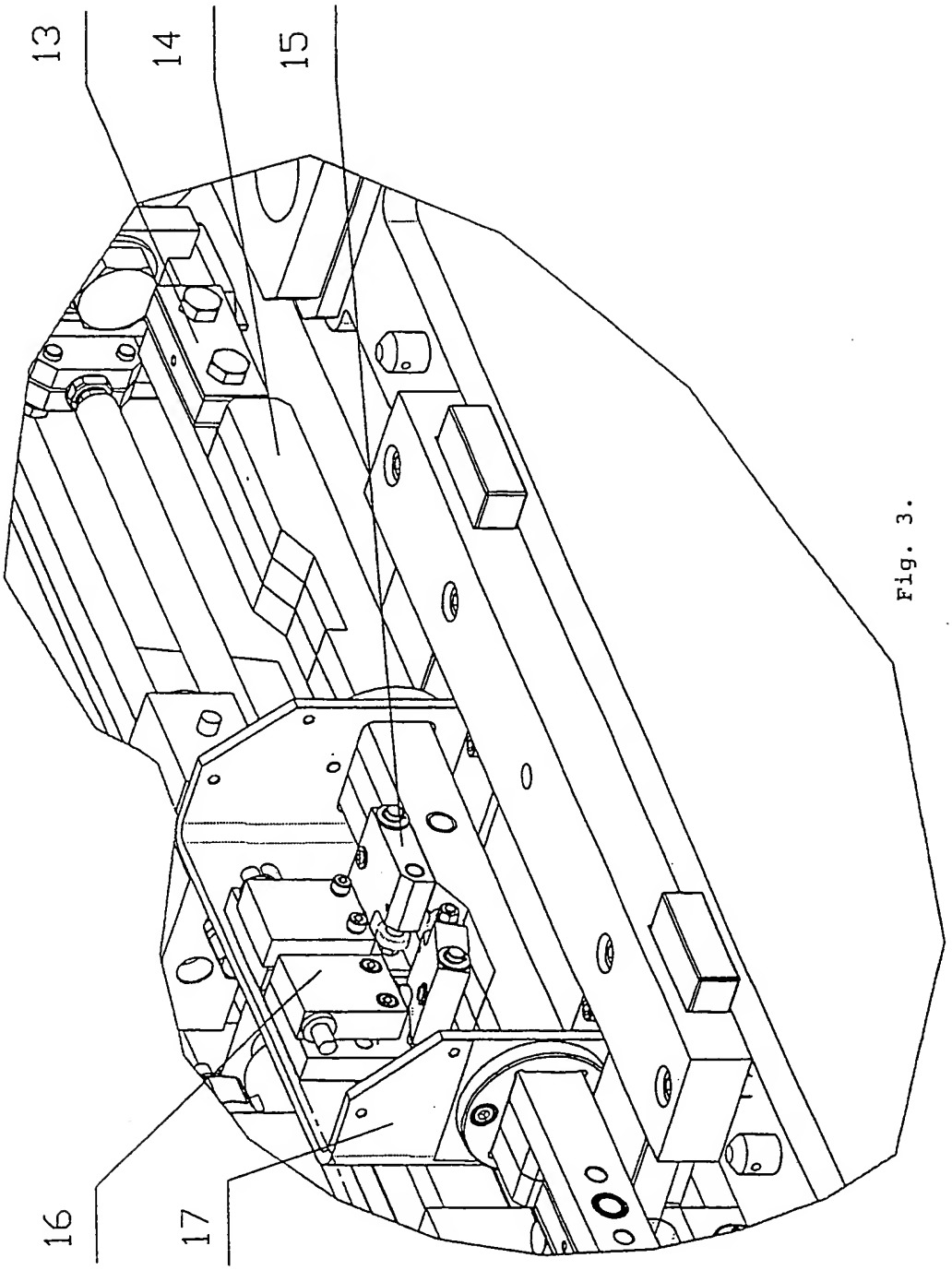


Fig. 3.

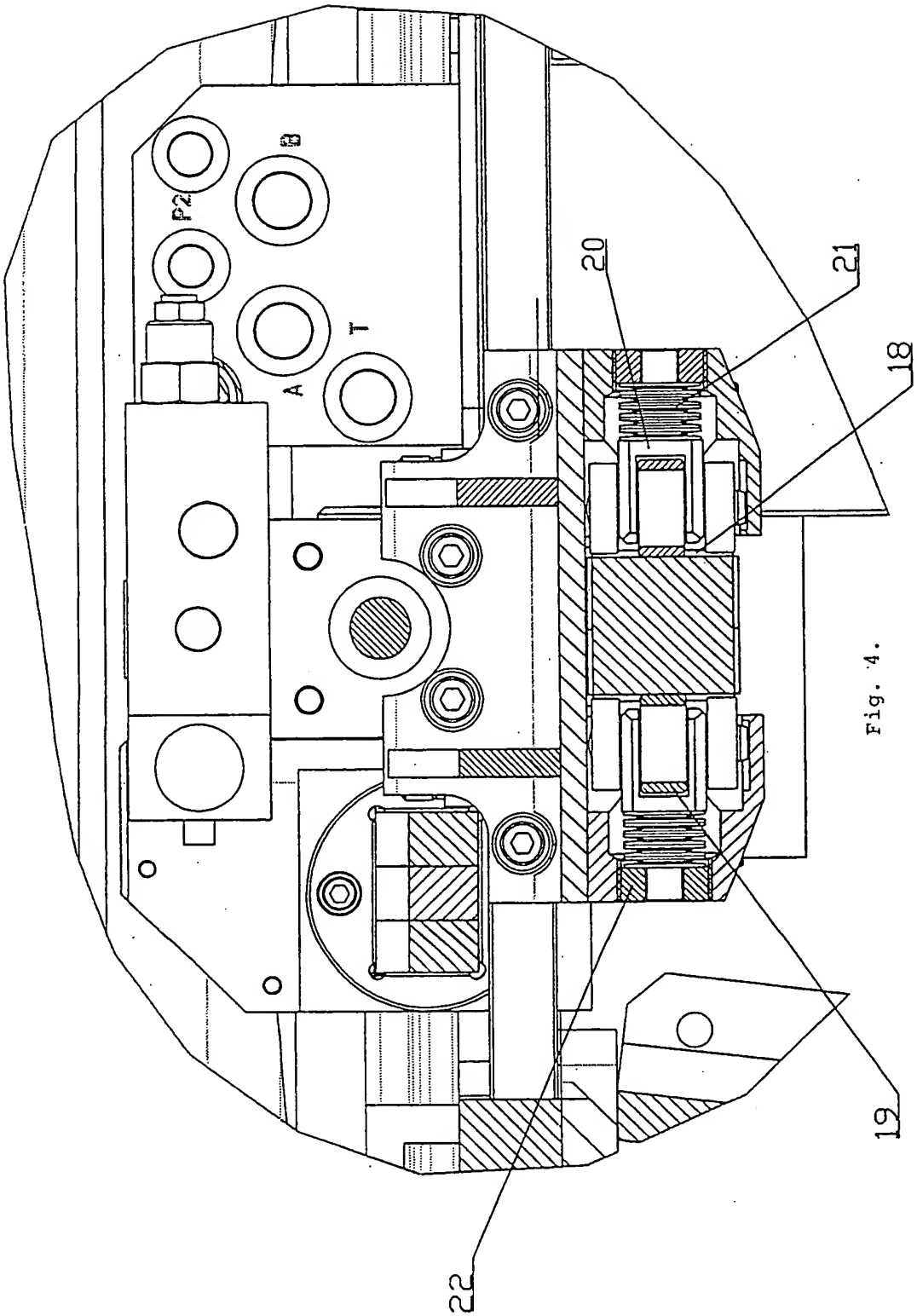


Fig. 4.

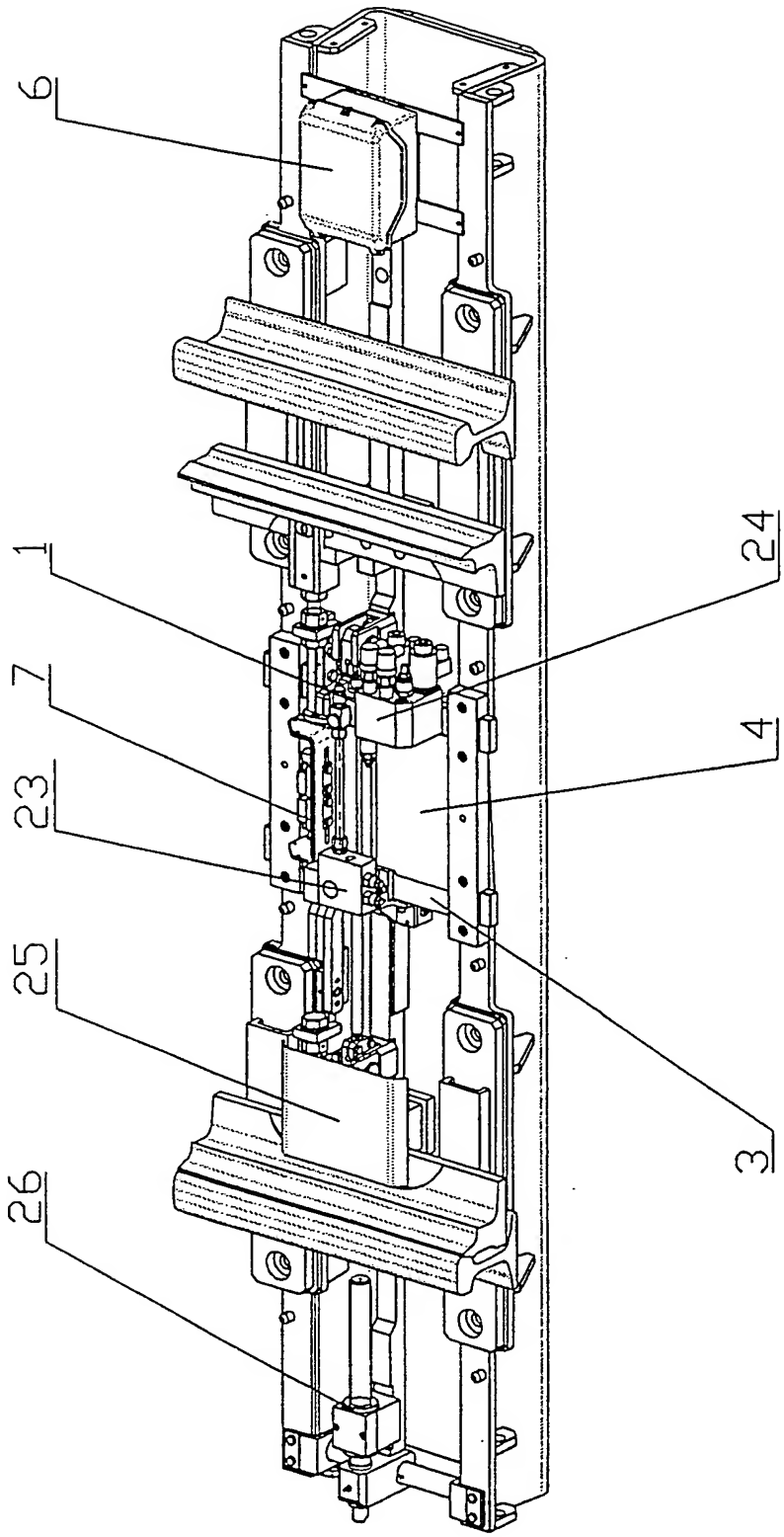


Fig. 5.

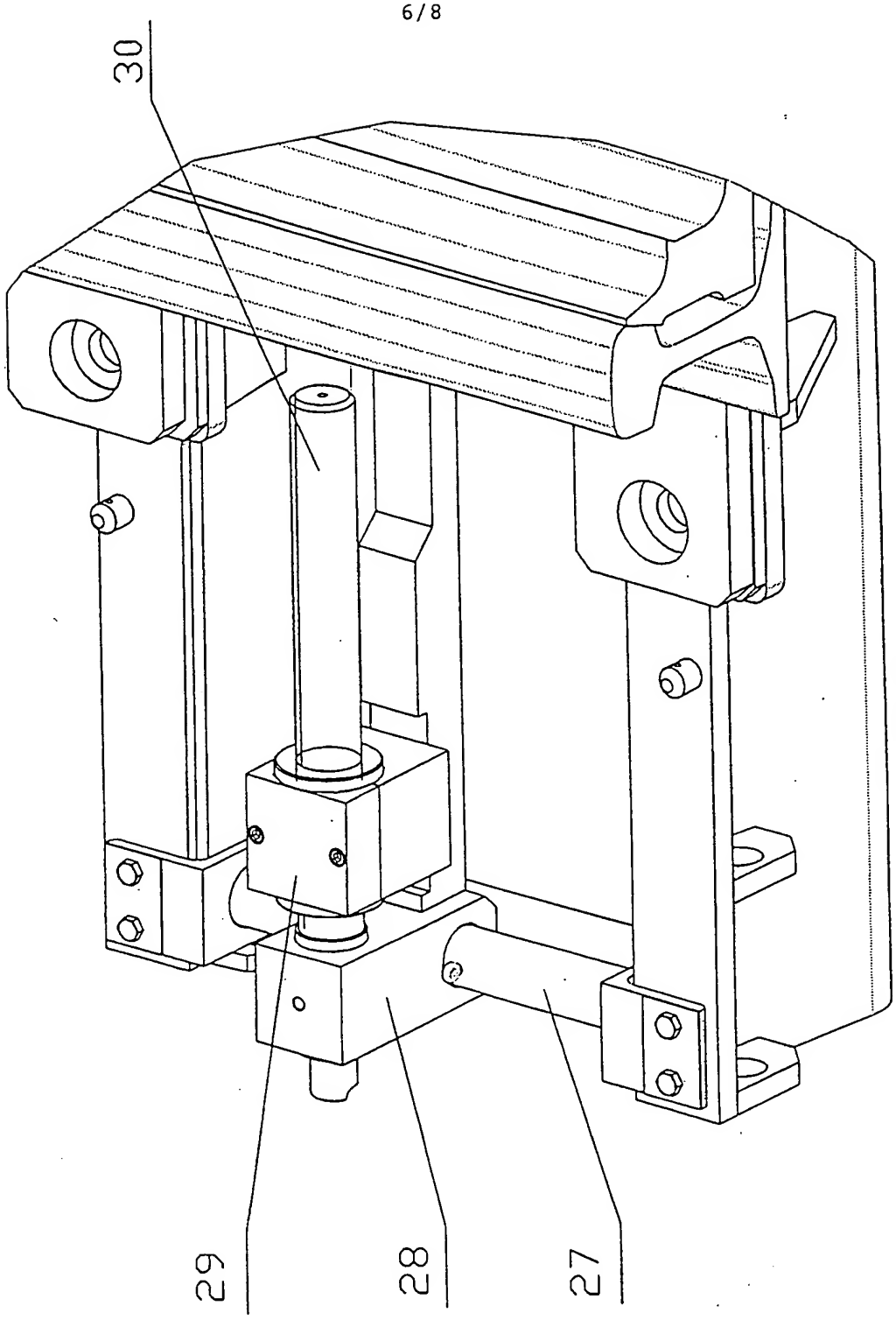


Fig. 6.

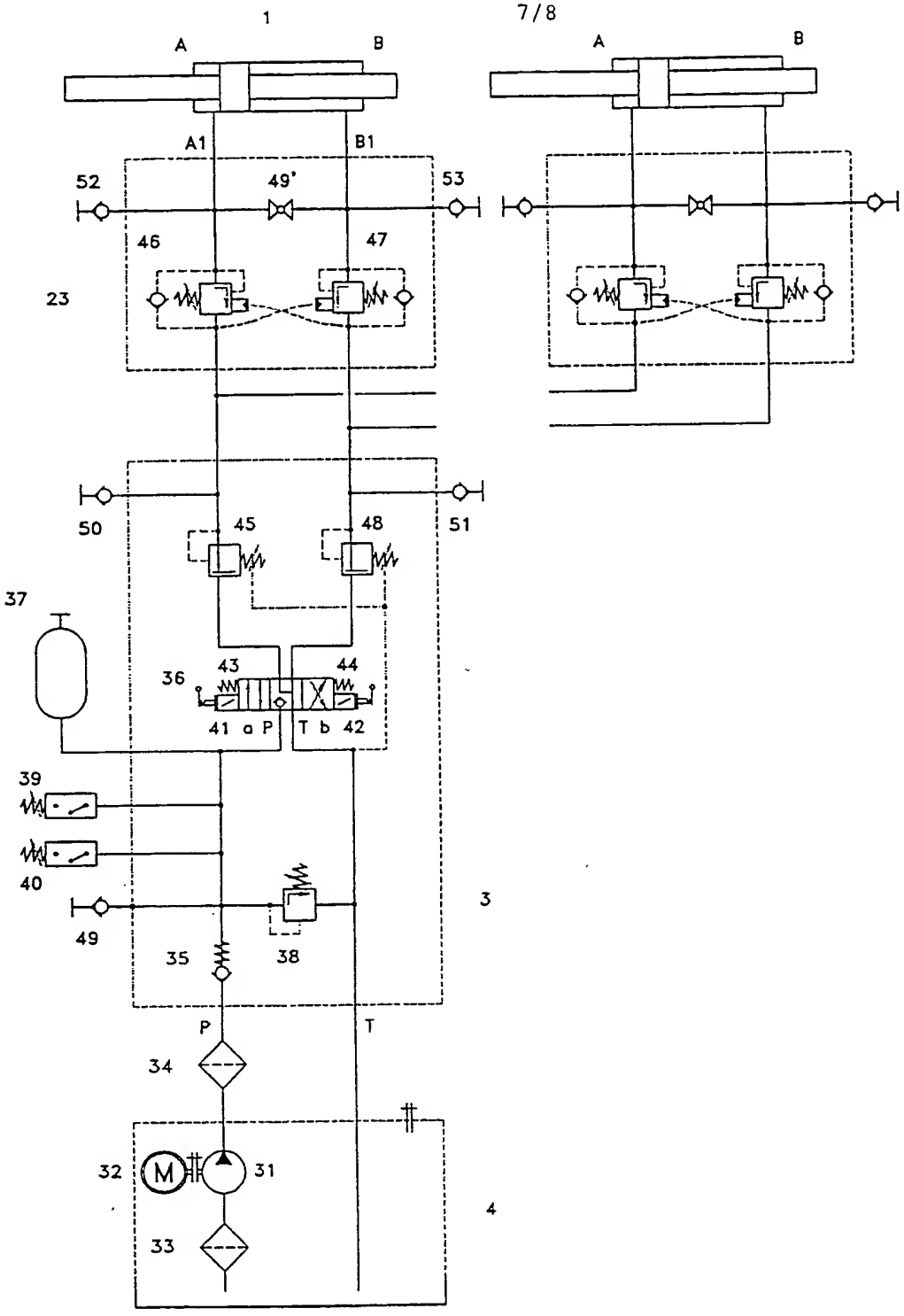

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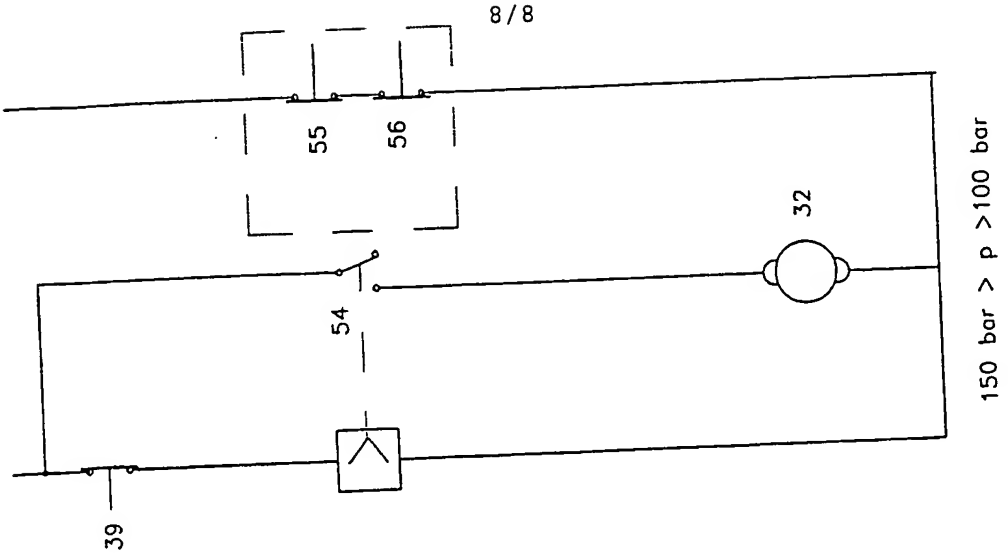
Fig. 7.



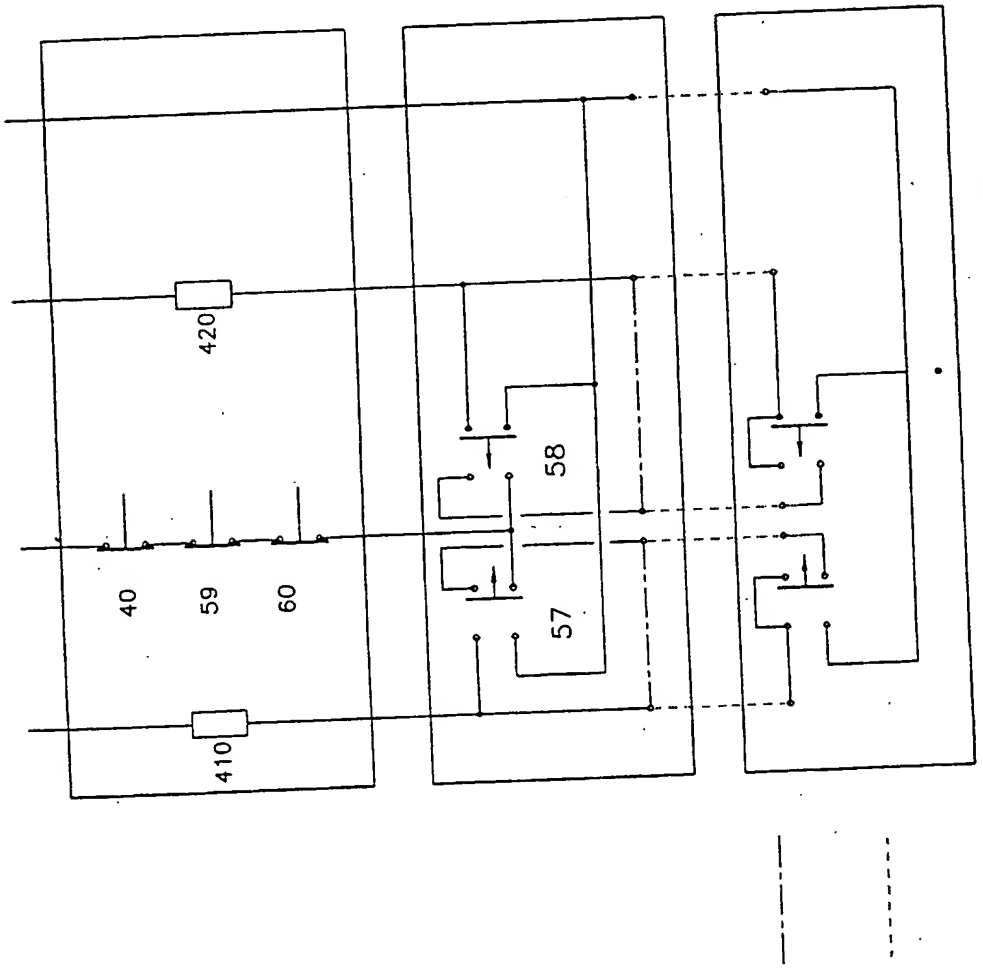


Fig.8.

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/HU 99/00044

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B61L5/04 B61L5/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 94 27853 A (ABB SIGNAL AB ;BERGGREN CLARENCE (SE); EKLUND LARS (SE); NORRGAARD) 8 December 1994 (1994-12-08) the whole document	1-4,6,13
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A	US 5 417 392 A (WYATT MICHAEL L) 23 May 1995 (1995-05-23) abstract; claims	1,9,10, 14-16

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
7 February 2000	14/02/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Reekmans, M

2

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INTERNATIONAL SEARCH REPORT

Inte onal Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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